SOME CONSIDERATIONS

Respecting the Parietal Bone,

. . . BY . . .

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The Museum
Queen's College,
Galway

26th 1904

[Dear] Sir,
I [send] herewith some
[recently] published papers by
[my]self for yr kind acceptance
I am. Sir
Yrs ffly.
(Sgd) Richard J. Anderson
M.D. M.A.

[The] Librarian,
Roy. College Surgeons
Lincolns Inn Fields
London

(Aus der Internationalen Monatsschrift f. Anatomie u. Physiologie. 1904.
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Some Considerations respecting the Parietal Bone.

By

R. J. Anderson,
Professor of Biology in Galway.

(With 83 Fig.)

The form and relations of the parietal bones are of so much interest that some references to details of relationship in special groups will not be wanting in importance. The size, absolute and relative, the extension of the borders and angles, and the thickness of these bones in some animals, point to various controlling influences during their growth. The condition of the nervous organs beneath seems for a longer or shorter time to influence the growth of the cranial bones proper. It may be conceded that the centres of ossification may count upon subjacent vascularity and nerve influence as potent factors. The other factors are the nature of the tissues, the muscle development, the growth of other bones and the nature of the pressures and impulses and the amount and distribution of the formative material. The fluctuations from time to time in the various factors make it difficult to say that bones of the same name exactly correspond in all cases. Indeed it is probable that they serve chiefly as keys to the situation, in each particular case. A bone indeed may be produced or altered by forces from within or from without and the adjustment of these forces may give rise to bones of the same shape, which are resultant of different forces.

It follows, therefore, that we can only approximately gain some knowledge of the position of the parietal bones. Commencing with a reference to the prehistoric Batrachia!

The interparietal fissure in Pelosaurus (Dyas) is nearly equal to the interfrontal suture although the parietals appear to be larger than the frontals, there are pre- and postfrontals of course. The parietal

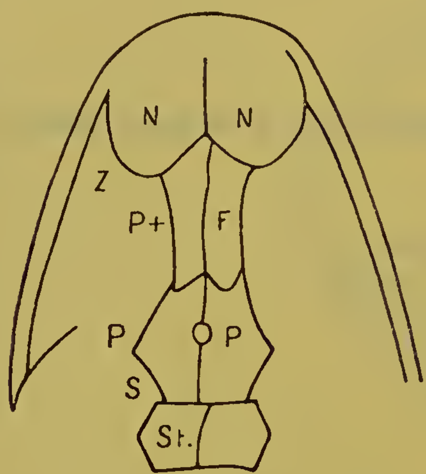

Fig. 1.
Pelosaurus.

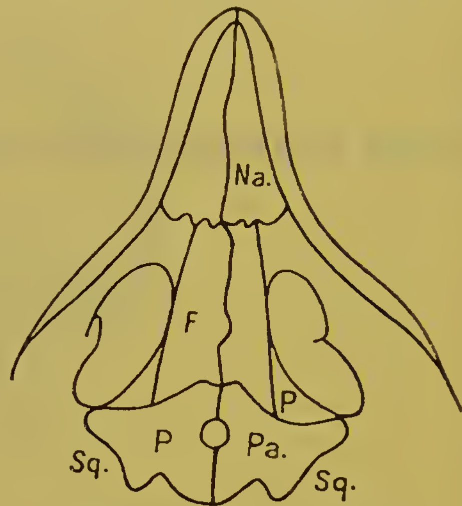

Fig. 2.
Procolophon trigoniceps.

suture is larger in Branchisaurus (Dyas). The interparietal suture in Archegosaurus decheni (Dyas Prussia) is half the length of the frontals in the middle line, but there are post Squamosals.

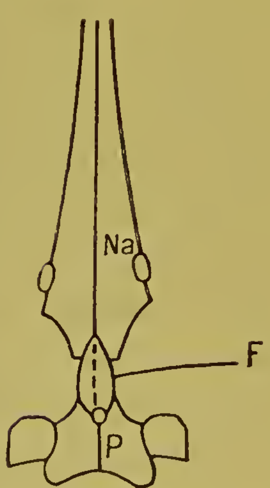

Fig. 3.
Ichthyosaurus.

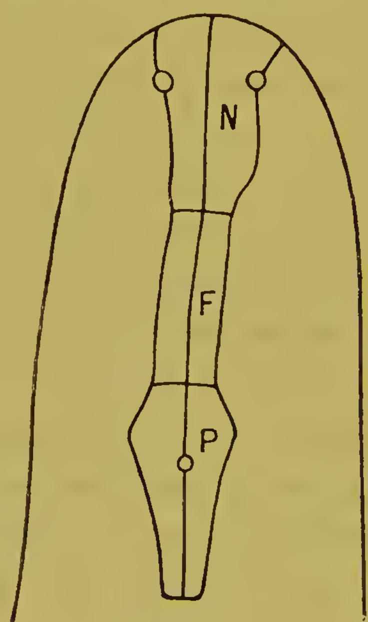

Fig. 4.
Palaeohatteria.

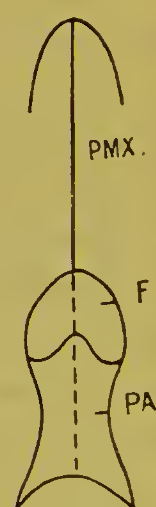

Fig. 5.
Plesiosaurus.

Anomodonta. In Procolophon trigonoceps the interparietal suture appears to be one third smaller than the interfrontal. Gordonia Traquairi shows a long parietal as well as an interparietal bone.

Ichthyosaurus has parietals larger than the proper frontals. The nasals, it will be remembered, are very long.

Palaeohatteria shows an interparietal fissure nearly equal to the antero — posterior diameter of the frontals in the middle line. The Nasals are broad.

Plesiosaurus has parietals that are longer than the frontals; there are however pre- and post-frontals, and post-orbitals.

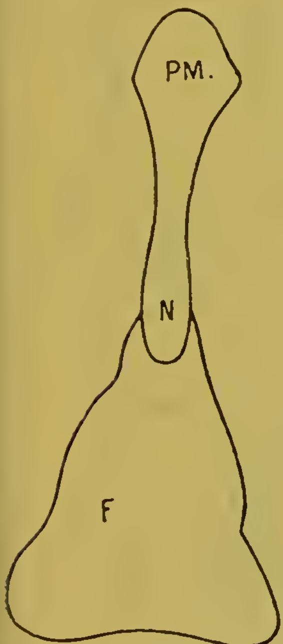

Fig. 6.
Platecarpus.

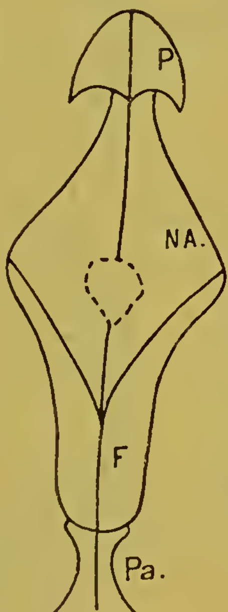

Fig. 7.
Archisaurus Colurus.

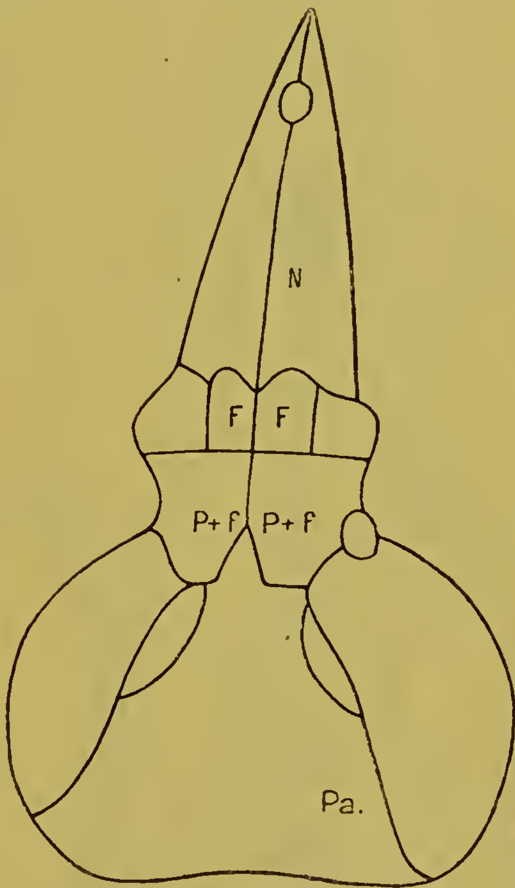

Fig. 8.
Triceratops.

Platecarpus (Cretaceous) has a large broad frontal but a small parietal, the narrow conjoined nasals lead forward to wider premaxillae. (S. Woodward after Merriam.)

Anchisaurus Colurus (Dinosaur; Trias) has broad frontals, and parietals that are narrow superiorly, also broad nasals.

Triceratops serratus presents an interesting extension of what are considered post-frontal bones.

The frontals are smaller. The parietals large. The pineal foramen is situated, apparently, between the pariteal and frontal, and although this opening is in the parietal bone, its position is plainly suggestive of the fact that the parietal bones bear interesting relations to the brain organs immediately behind the Epiphysis.

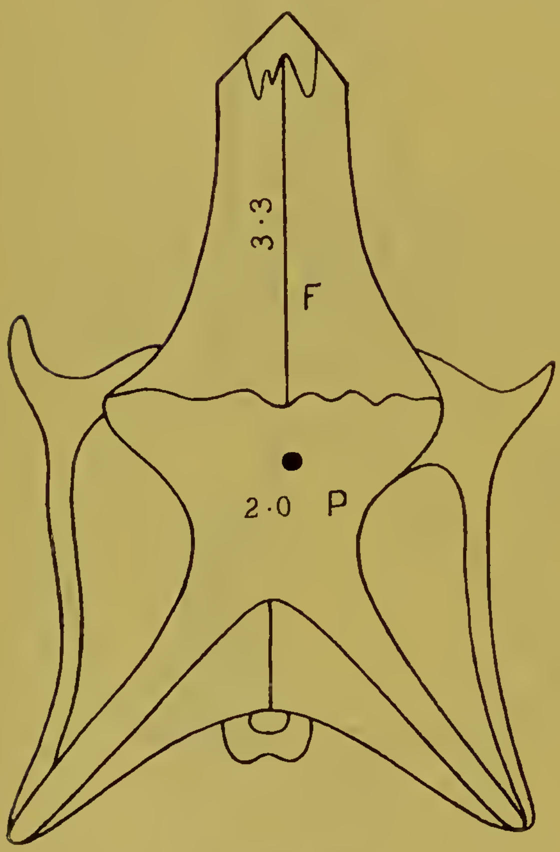

Fig. 9.
Nilelizard.

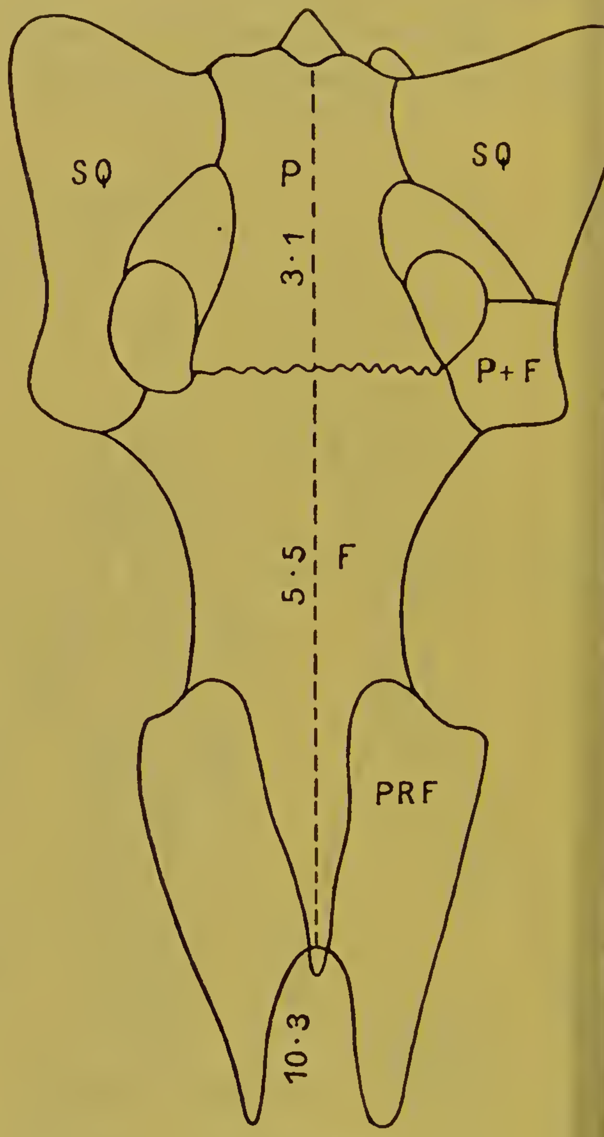

Fig. 10.
Alligator.

Belodon. Frontals seem large compared with parietals and in Pelagosaurus the latter are small and fused as are the two frontals also.

In Notosuchus terrestris (Cret.) the parietals are narrow and fused. Frontals broad and fused. Antero-posterior diameters of these united bones equal.

In Galesaurus planiceps the antero-posterior diameter of the frontal is two thirds that of the parietals. A prefrontal is figured by Zittel.

Placodus gigas (Muschelkalk) has the antero-posterior diameters of the frontal and parietal bones equal (Zittel).

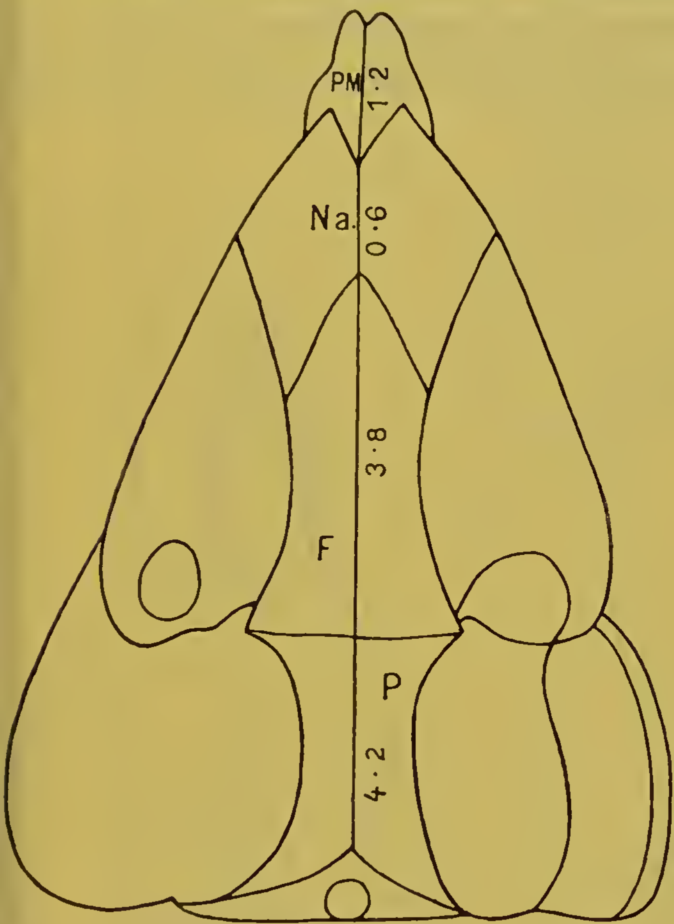

Fig. 11.
Hatteria punctata.

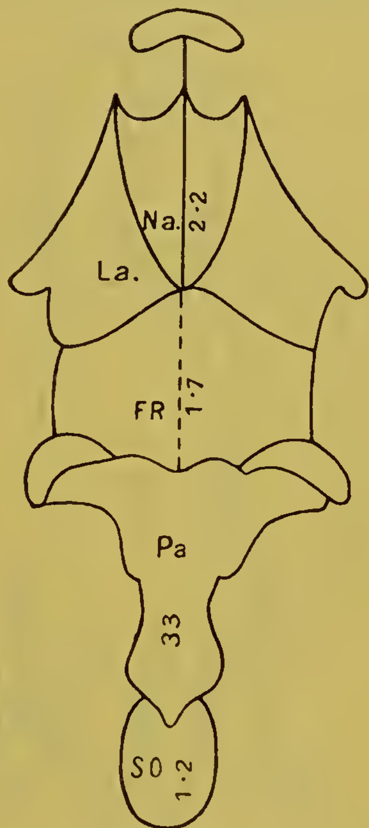

Fig. 12.
Boa.

				Parietal	Frontal
A	large	Nilelizard	has	2,0 cm	3,0 cm
„	„	Alligator	„	3,1 „	5,0 „
„	„	Turtle	„	4,0 „	1,5 „
„	„	Hatteria	„	4,2 „	3,8 „
„	„	Boa	„	3,3 „	1,7 „

				Ant. Par. lat.	Frontal
A	large	Struthio	has	1,2 × 2,5 cm	3,0 cm
„	„	Owl	„	0,6 × 1,0 „	2,5 × 1 „
„	„	Gallus	„	0,8 „	2,8 „

The breadth of the parietal exceeds the antero-posterior diameter in these birds. The interparietal suture does not reach the full length of the Cerebral Cavity in the ostrich (Struthio). The parietal bone is thickish externally and posteriorly. The bone is much thinner anteriorly, the frontal takes a great part in roofing of the Cranial Cavity.

The transverse diameter of the parietal bones in Gallus (var) is one third greater than antero-post diameter, which is one fourth

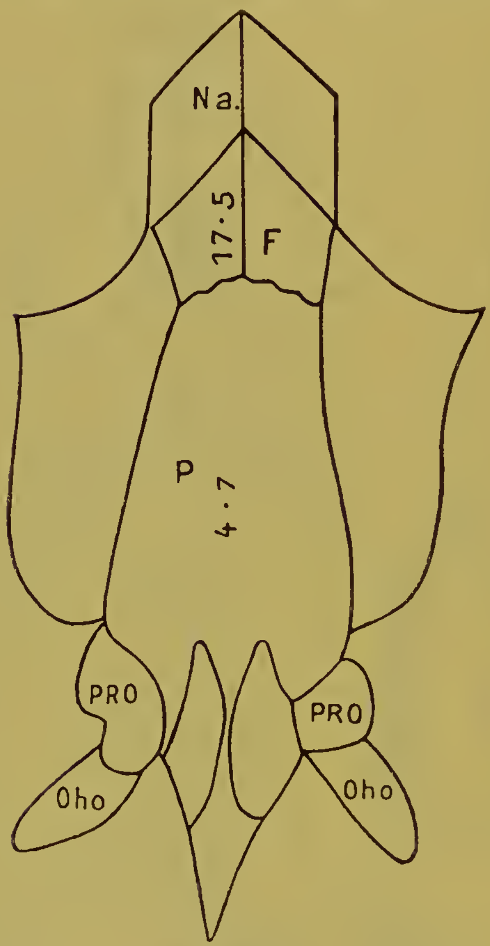

Fig. 13.
Turtle.

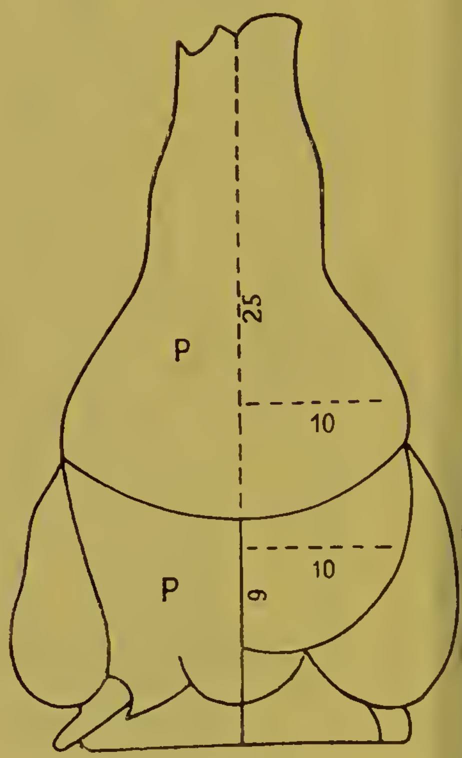

Fig. 14.
Owl.

the length of the interfrontal suture. The parietal bones are thick externally, and become thin near the middle line at 2 mm distance. They are thickest at the postero-lateral part. They are somewhat thinner in front of this, along the outer border. The parietals in relation to the Cranial Cavity are larger in the owl and they are thin. The parietals in parrot are also thin. The question arises whether the thickening is due to comparative retrocession of the brain

in the first named birds or to the more forcible operations engaged on by the beaks of the rasores (v. Cursores). The interparietal should be regarded apparently as an occipital segment (Meckel). Indeed, at an early age, it is frequently joined to the hind-head bone.

The inflated brain in some of the mammalian orders causes so much extension of the parietal, and frontal bones, that it is difficult or impossible to estimate the value of the nervous system beneath in

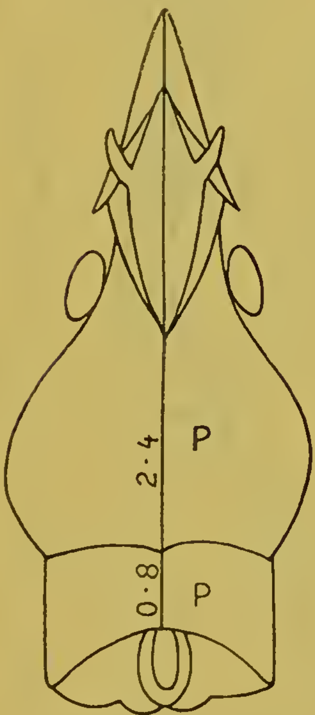

Fig. 15.
Gallus (Var.)

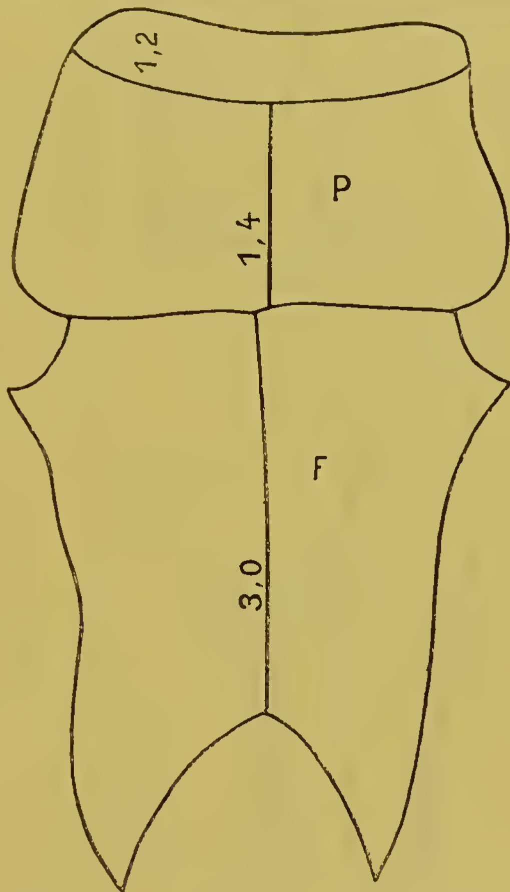

Fig. 16.
Struthio.

producing the increased size as compared with the influence of muscular activity and the impulses conveyed from without through the sutural surfaces. The parietal is in contact with the occipital bone and must be influenced by vertebral impulses, and along the maxillae, jugals, temporals, and sphenoids, impulses travel that affect the nutrition of the frontals and parietals. This bone seems a more accurate index of brain inflation in the higher groups, where it becomes not only large and square but arched. Whatever is the origin of this

segment originally it has a very important relationship to the perhaps most important nerve centres of the adult Homo. If however we compare the skull of the beaver (Castor) with that of Capybara, the heavy skulled South American rodent has a parietal much shorter

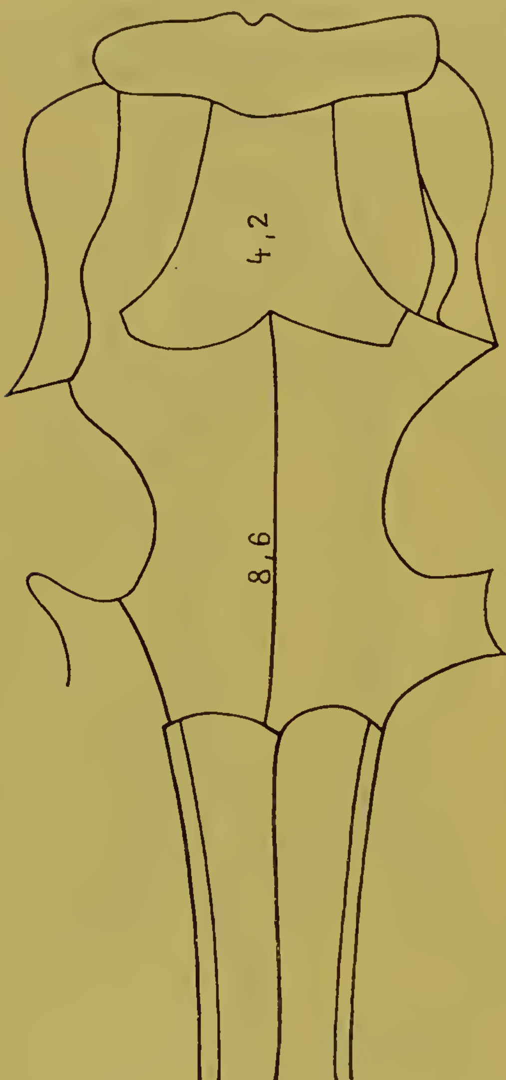

Fig. 17.
Capybara.

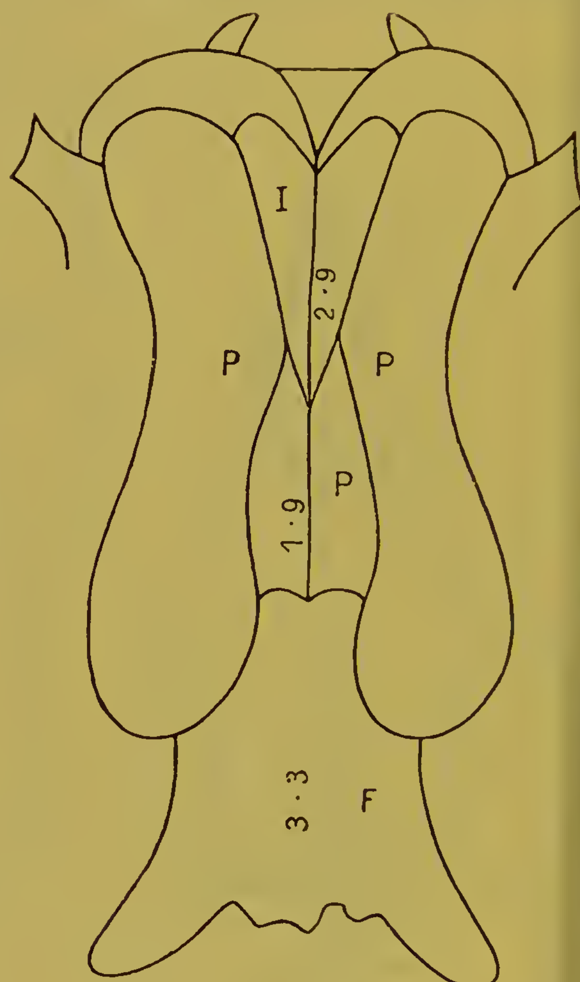

Fig. 18.
Castor fiber.

than the frontal, whilst in the beaver, at the sides, it is enormously longer, but in the frontal the greatest breadth in the beaver is in the middle line, there is also a large inter parietal. The length of brain cavity in Capybara is 9,5 cm. The following represents the series of mammals measured.

	P.	F.	N.
Halichaerus	3,3 cm	5,4 cm	5.0 cm
Cystophora	2,3 "	3,5 "	3,0 "
Helarctos (Juv.)	3,3 "	5,5 "	2,7 "
Helarctos (Mid.)	5,0 "	7,8 "	3,8 "

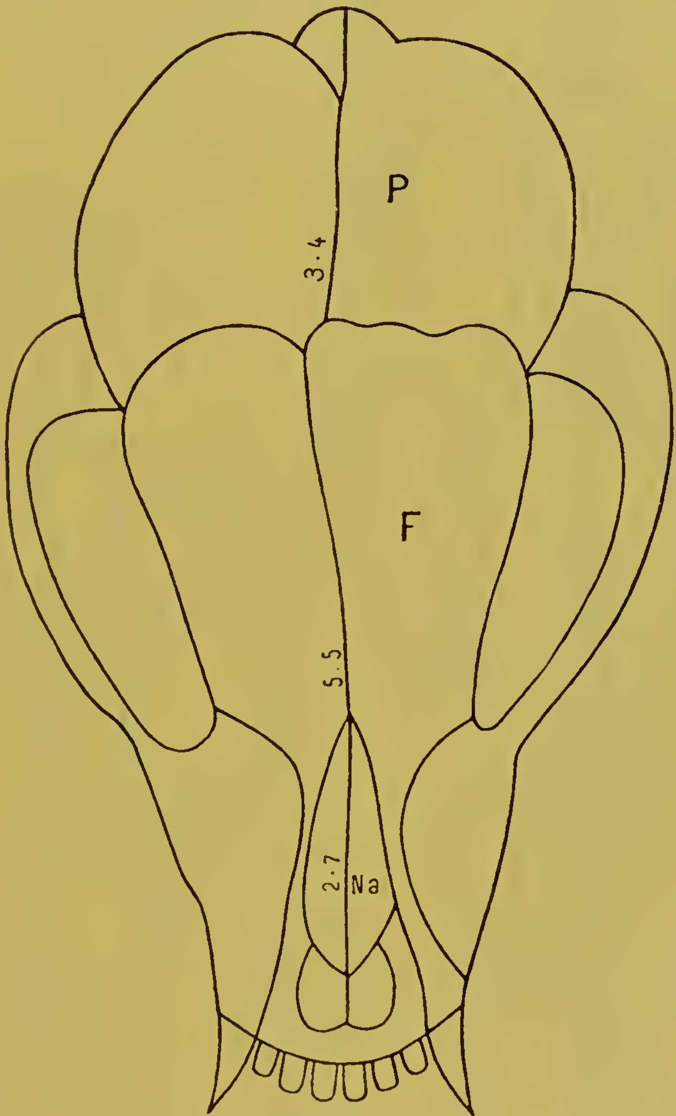

Fig. 19.
Helarctos (Juv.).

	P.	F.	N.
U. Polaris	2,4 cm	2,4 cm	2,7 cm
Felis Concolor	2,5 "	3,3 "	
Leo	10,0 "	8,8 "	
Tigris	5,7 "	7,8 "	6,0 "

	P.	F.	N.
Felis Cattus	3,0 cm	3,0 cm	3,0 cm
Panther	7,2 „	6,4 „	4,5 „
St. Bernard Dog	2,2 „	2,6 ..	3,6 ..
C. Azarae	3,2 „	4,3 ..	5,0 ..
Sheep Dog	4,5 „	5,3 ..	5,5 ..

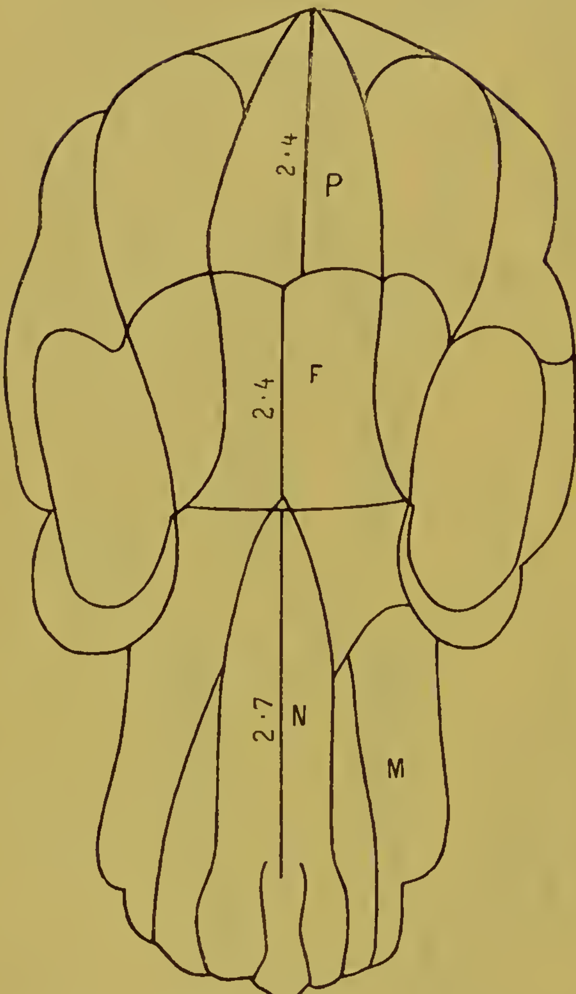

Fig. 20.
Ursus polaris.

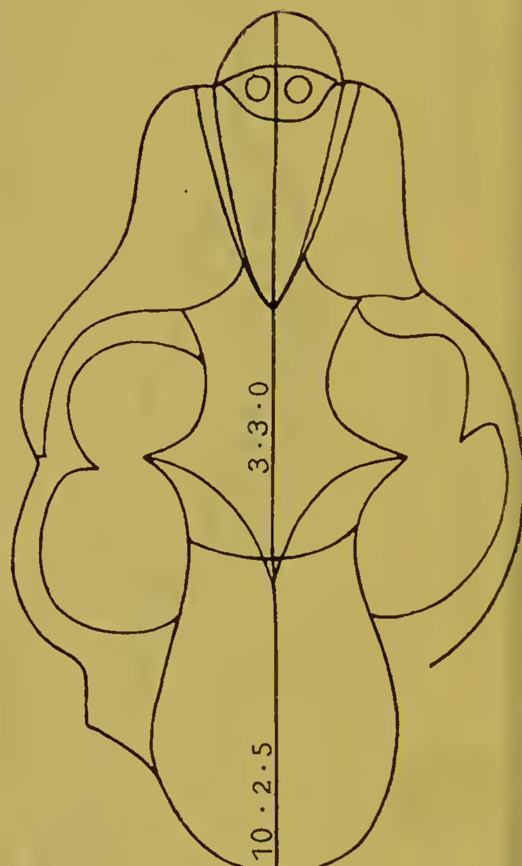

Fig. 21.
Felis concolor.

	P.	F.	N.
Irish Dog	3,1 cm	3,8 cm	4,1 cm
Lupus	5,5 ..	7,0 ..	7,5 ..
		9,0 .. (lat.)	
Vulpes	2,8 ..	4,2 ..	4,6 ..
Ursus arctos	6,2 ..	7,5 ..	6,0 ..
		9,7 .. (lat.)	

Phalangista gives an mesial frontal measurement of 2,5 cm and an mesial parietal 2,2 cm.

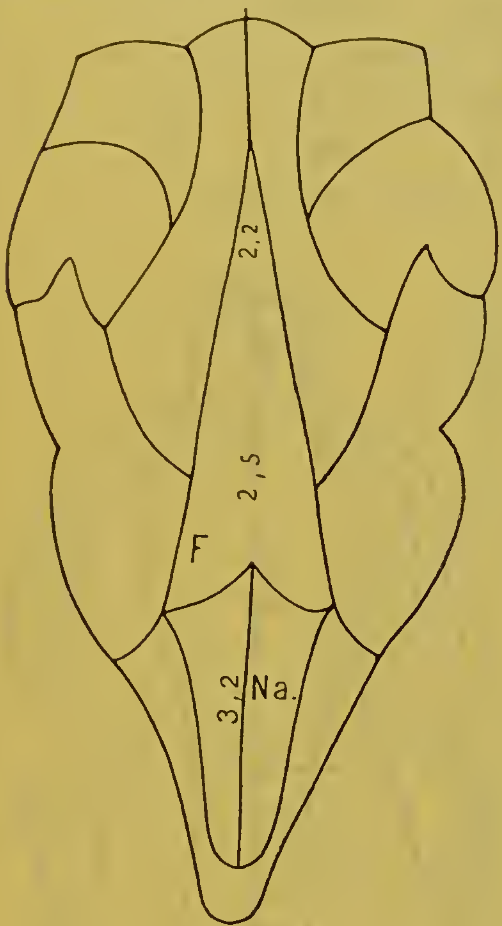

Fig. 22.
Phalangista.

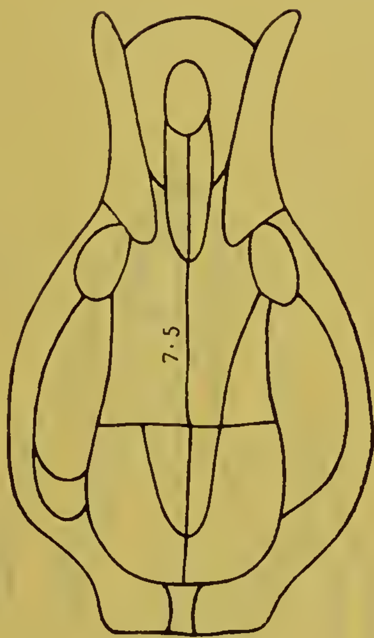

Fig. 23.
Ursus arctos.

	P.	F.	N.
Bradypus	3,0 cm	3,6 cm	1,3 cm
Lemur.	3,5 „	4,1 „	3,0 „
Pteropus	2,2 „	2,2 „	2,0 „
Galago	2,1 „	2,4 „	1,5 „
	2,6 „ (lat.)	1,8 „ (lat.)	
Centetes	1,0 „	2,5 „	2,8 „
	2,2 „ (lat.)	2,5 „ (lat.)	
Erinaceus	1,3 „	1,8 „	1,5 „
	2,2 „ (lat.)		
Mycetes	2,9 „	4,9 „	2,7 „
	5,0 „ (lat.)	5,5 „ (lat.)	

	P.	F.	N.
Cebus	3,4 cm	5,7 cm	1,5 cm
Mycetes (young)	4,6 „	5,2 „	1,7 „
	5,7 „ (lat.)		
Green Monkey	3,5 „	4,0 „	1,2 „
Troglodytes (young)	6,5 „	6,5 „	2,3 „

(P. = Parietal. F. = Frontal. N. = Nasal.)

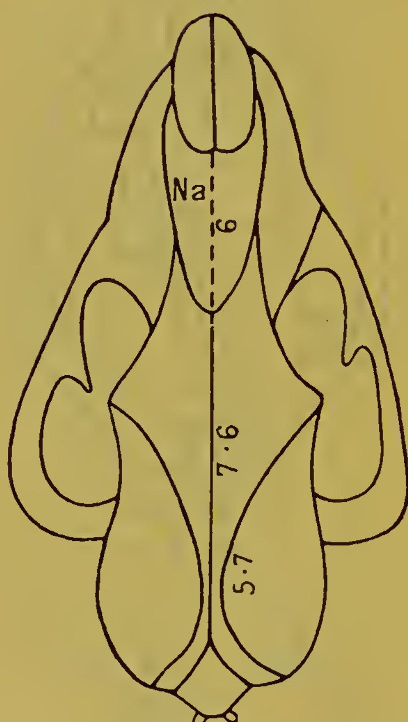

Fig. 24.
Felis tigris.

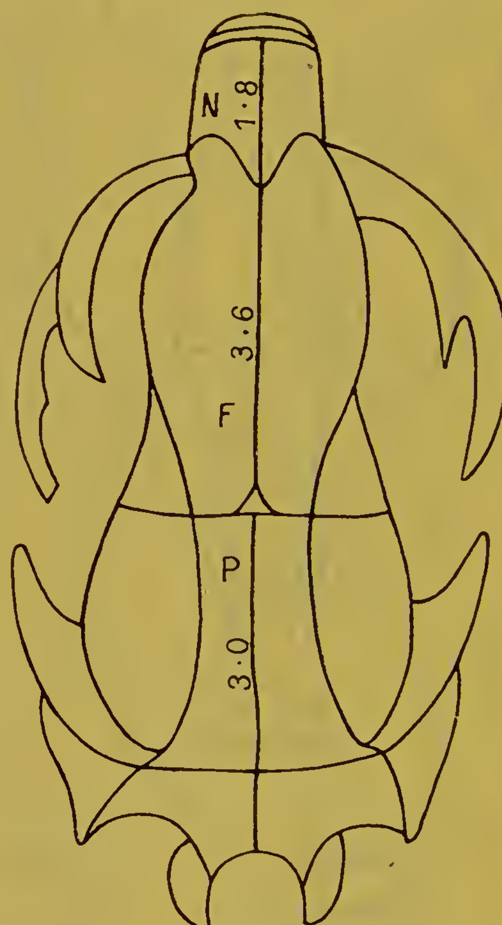

Fig. 25.
Bradypus.

The types selected show some of the most interesting variations and great lateral extensions in some become of interest when compared with the mesial antero-posterior diameter. The frontal comes first into operation in affording resistence to impulses given to the maxillae and the temporal experiences the impulse of the mandibles. The jugals

sphenoids, and lachrymals being intermediaries in certain directions. It will be seen that even in the same genus considerable variations may occur. The relative proportions may be maintained by alteration of the forces whatever these may be, so that a growth forward of the parietals in the middle line may bring the interparietal fissure up to

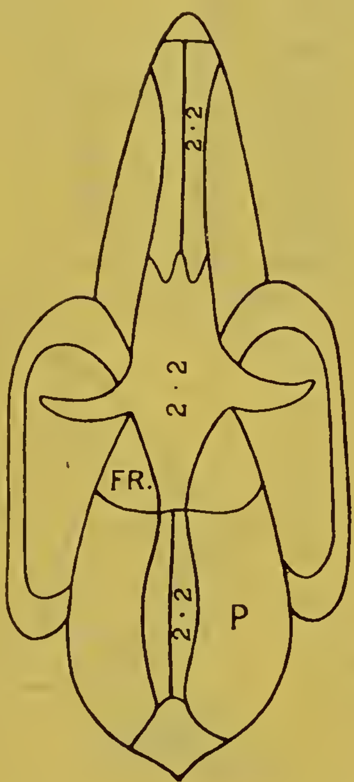

Fig 26.
Pteropus Edwardsi.

the length of the interfrontal fissure, or shortening may take place in the frontal so that the same proportion may be brought about. The anterior inferior angles may be studied as they advance or recede relatively to the neighbouring bones.

The following table II gives a collected list of some rodents and Ungulates.

	Nasal	Length of skull	Fr.	Par.	Parbreadth Ant.	Post.	Height of skull not mandible	Length of cranial cavity
	cm	cm	cm	cm	cm	cm	cm	cm
Capybara	—	25,0	8,0	4,3	6,5	5,0	6,0	8,5
Beaver (Castor)	—	12,5	3,5	4,5+6	2,0	2,5	5,5	6,6
			2,5 (lat.)	I. P. (lat.)				
M. Rattus	—	5,0	1,9	0,8.0,5	1,2	1,3	1,3	2,4
				I P.				
Rabbit (Cuniculus)	3,3	8,5	3,0	1,8.0,8	1,4	1,1	3,5	4,3
Hare (Lepus timidus)	2,0	8,0	3,1	2,0	1,5	1,2	3,3	4,2
Cephalelaphus	5,5	14,5	6,0	2,0	4,5	9,0	—	7,0
Acronotus	18,0	39,0	22,0	3,5	2,0	4,0	—	—
Equus	13,0		7,0	13 + 2,5	5,0	5,5—4	10,0	17,0
Antilope	—	18,0	5,4	4,5	4,1	1,5	—	8,5
Bos juv.	15,5	40,0	19,0	3,5	6,0	5,5	—	12,5
Ovis	9,0	25,5	8,5	3,5	5,0	3,0	—	9,2
Ovis II	8,5	23,5	9,5	4,0	2,5	—	—	9,5
Cervus	6,0	19,0	6,4	3,0	2,5	7,5	—	9,0

lat. = lateral diameter; I. P. = Inter Parietal; Ant. = Anterior; Post. = Posterior.

Fig. 27.
River Dolphin.

The River Dolphin has parietals that approach those of Proboscidia.

The frontal in advancing backwards in the middle line may lead to complete obliteration of the interparietal suture. Owen gives the case of a Cebus in which the frontal touched the occipital and separated the parietals. The same observer met also with a gibbon (Hylobates) in which the same variety occurred. The growth of the maxillae and occipitals causes the well known quaintness in the skulls of cetaceans. The frontals thus become largely hidden and the parietals shrink. The latter bones have a forward extension at the anterior inferior angle in several groups whilst in others the parietals do not reach the sphenoids owing to the alae being less developed or to the

Temporal shutting out the parietals. The parietals in the capybara beaver, tapir and elephant and several others do not touch the

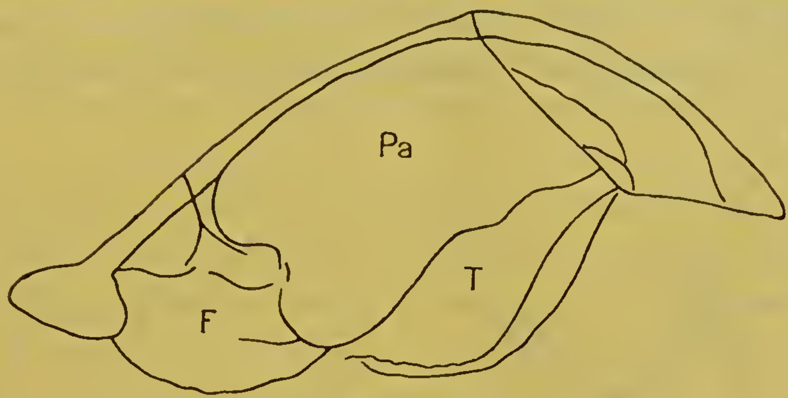

Fig. 28.
Elephas (Juv.).

sphenoidal alae, whilst in a very large number of genera these bones do touch.

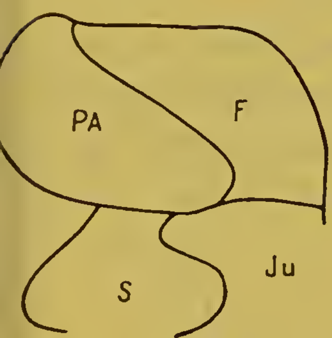

Fig. 29.
Cebus capucinus.

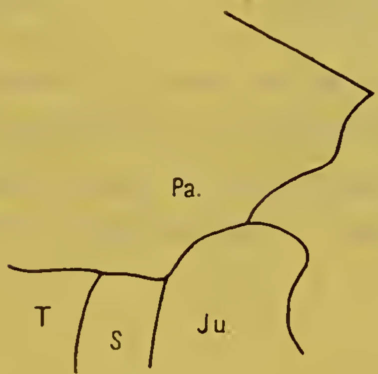

Fig. 30.
Callithrix.

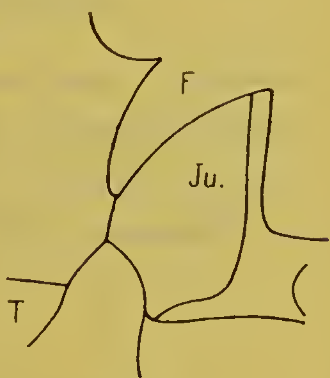

Fig. 31.
Monkey (S. America).

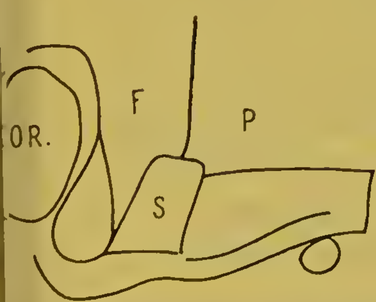

Fig. 32.
Mycetes.

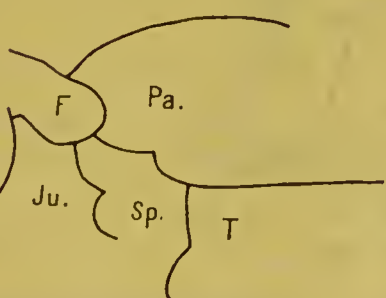

Fig. 33.
Reuwowler.

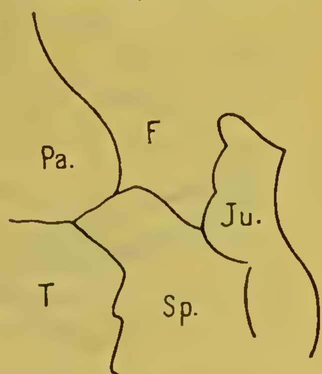

Fig. 34.
Cercopithecus.

The parietal in the Quadrumana presents some interesting varieties. The sphenoid is shut off from the parietals in Homo (sometimes), in Orang (Satyrus) occasionally, Gorilla generally (there is sometimes a

point of contact between the anterior inferior angle of the parietal and the sphenoid). One finds this separation in Hylobates Mülleri, Semnopithecus obscurus, in some skulls of Semnopithecus entellus and Macacus Cynomolgus also in Macacus rhesus and Cynocephalus for-

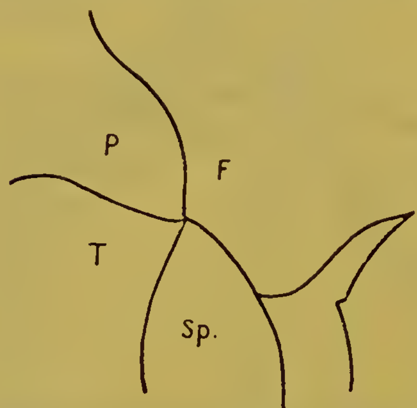

Fig. 35.
Macacus nemestrinus.

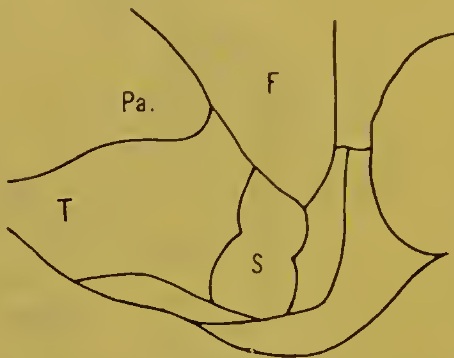

Fig. 36.
Macacus Rhesus.

micarius. Owen mentions the case of a Boschman where the usually parieto-sphenoidal articulation did not exist and cites another example, but the variety is well known to human anatomists. Owen figures a Chimpanzee without a parietal-sphenoid-suture. Flower thought

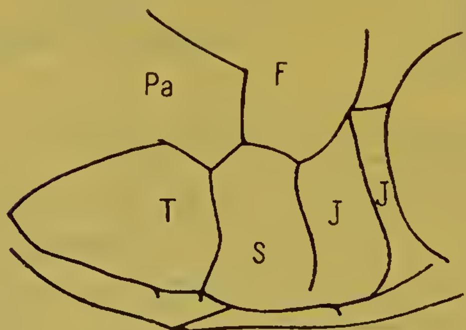

Fig. 37.
Macacus Rhesus.

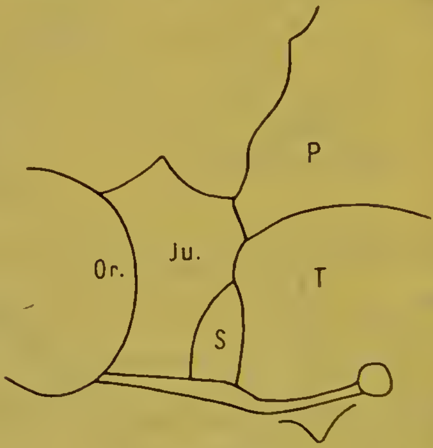

Fig. 38.
Hylobates (Müller).

that the separation of the parietal from the sphenoid was almost always the case in Primates (Quadrumana). The rule holds for Cynocephalus anubis, Cynocephalus Sphinx and Cynocephalus Niger all of which have their parietals separated from the Alae of the Sphenoids. The alisphenoids (Cartilaginous parts) as we know, lie

between the exit of the optics and tergeminal nerves, or they may partially or entirely enclose the latter (Parker).

The parietal touches the sphenoid in Cystophora, Hyaena, Ursus polaris, Hyrax, Dugong, Kangaroo, Lemur, Canis, Felis, Prosimia, Galago, Loris gracilis (by a point), Nyticebus, Lepidolemur, Propithecus, Indris, Chiromys. Hapale, Pithecia, Lagothrix, Cebus, Mycetes, Cercopithecus (sometimes), Macacus rhesus (some), Semnopithecus entellus (some), Orang (mostly acc. to Flower), Gorilla and Troglodytes sometimes, Hylobates hainanus. The parietal usually articulates with the sphenoid in Homo and the suture is sometimes long (2—3 cm long). A cercopithecus is figured by Owen, which has a Parieto-sphenoidal suture on the left side but not on the right.

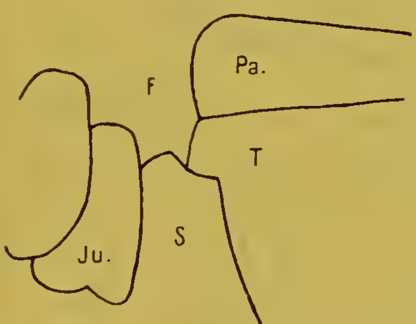

Fig. 39.
Simia Satyrus.

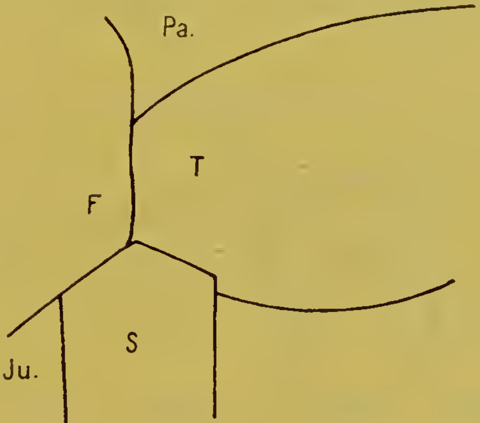

Fig. 40.
Gorilla (Manchester).

Loris gracilis, semnopithecus leucoprymnus Gorilla (?) and Homo have sometimes a very much reduced parieto-sphenoidal fissure.

The influence of confinement and climate, as well as food, may tend to produce wormian bones and these may unite to one of the bones abutting on the fontanelles thus giving rise to seeming natural varieties. Some varieties must be studied in the light of other facts such as wormian bones being found elsewhere in the same skull. It may also be stated that collectors have found considerable variations in the same species.

An interesting variety occurs also in some American Monkeys and in Hylobates Mülleri. Namely an articulation between the parietal and jugal.

The parietal touches the jugal in Hylobates Mülleri and separates the frontal from the portion of the sphenoid that lies in the outer wall of the skull. The temporal also touches the jugal in this animal so that the sphenoid is separated from the parietal. The parietal touches the sphenoid in cebus and also the jugal. Callithrix has the same arrangements and the marmosets follow the same rule. In Chrysothrix, however, the parietals articulate with the jugals but are separated from the sphenoids by the forward extension of the temporals. In the Lemur, Tarsius Spectrum, the same arrangement is very nearly accomplished also.

I may be permitted to mention here the proportion of the diameters in the parietal bones of a chick in early life. In a chick 13 days in-

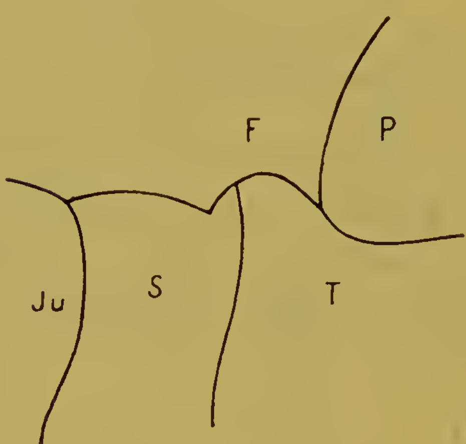

Fig. 41.
Arab.

Fig. 42.
Esquimaux.

cubated the frontal measured 13 mm in the antero-posterior diameter by 5 mm at the base and the parietal 3 mm along the antero-posterior diameter internally by 5 mm transverse the squamosal 4 mm antero-post by 3 mm side to side.

The parietal bones are scales set in membrane.

In a chick somewhat younger.

Frontals 11 mm long pointed at both ends.

Parietals 3 mm long by 5 mm broad.

In a full time chick.

Frontal 20 mm antero-posterior and 11 mm at base.

Parietal 5 mm antero-posterior and 8 mm broad.

Squamons 8 mm from front to back and 5 mm from above down.

The Cynomolgus mentioned above and some other monkeys had wormian bones. In one human skull which had a temporo-frontal suture 20 mm long and a sphenoidal alar-frontal suture 11 mm long Wormian bones were found in the lambdoidal suture.

It is probable that the forward and downward extension of the parietal is due to greater formative activity in that bone developing tissue and that this is brought about by internal conditions or by the condition of the skin tissues without. This would in itself tend to produce an articulation further forward in case the formative activity of the anterior bones were diminished. On the other hand the development of the alisphenoid may be arrested by the pressure of other bones or teeth not to speak of the actual absorption of the bone. Thus two bones may be separated so far as to give place for the advance of other bones into the interval.

It would seem, therefore, that the size and shape of the parietals depends on:

a) The nature and vascularity of the nervous parts beneath.

b) The vascularity and structure of the superficial tissues.

c) The relative activity of the formative tissue along the margins of adjacent bones.

d) This includes the greater or less tendency in adjacent bones to advance.

e) The impulses that are conveyed to the bones from without.

f) The extension of certain muscular attachments.

g) The effect of artificial feeding which may alter the formative processes in each case.

h) Actual disease.

The writer has to acknowledge his indebtedness to the works of Zittel, Woodward, Huxley, Owen, Parker, and the ever fresh Meckel, Forbes, records have been consulted.

The Museums of Dublin, Glasgow, Liverpool, Manchester and Galway have furnished specimens from which most of the outline drawings have been made. These sketches explain themselves.

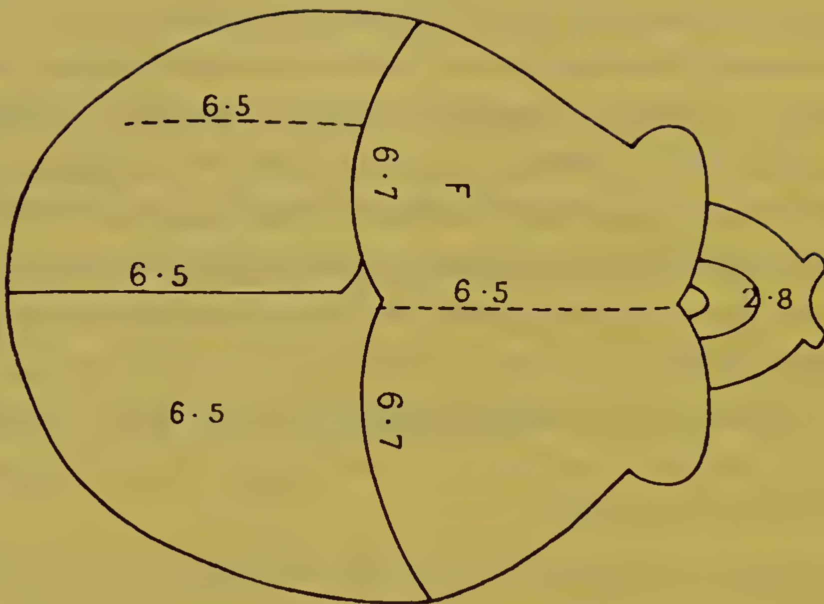

Fig. 43.
Skull Chimpanzee.

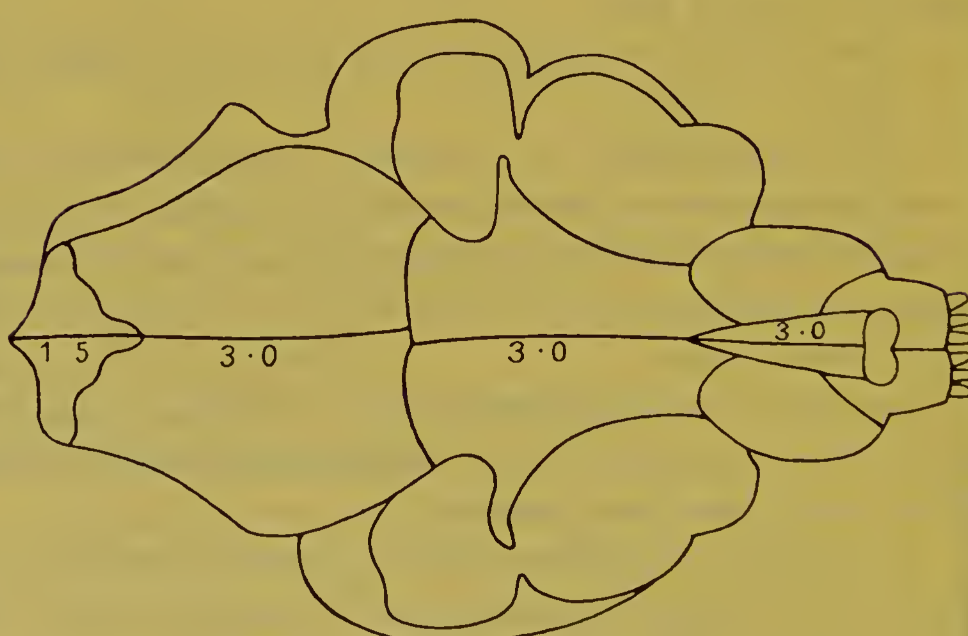

Fig. 44.
Felis cattus.

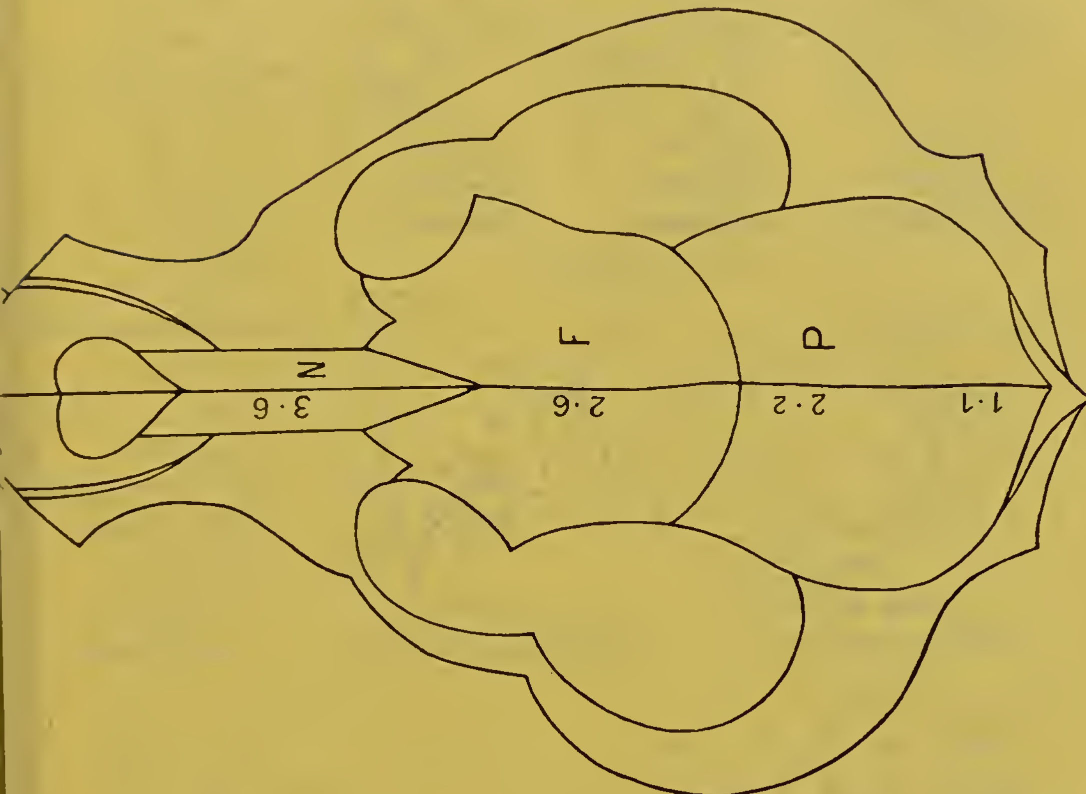

Fig. 45.
St. Bernard Dog.

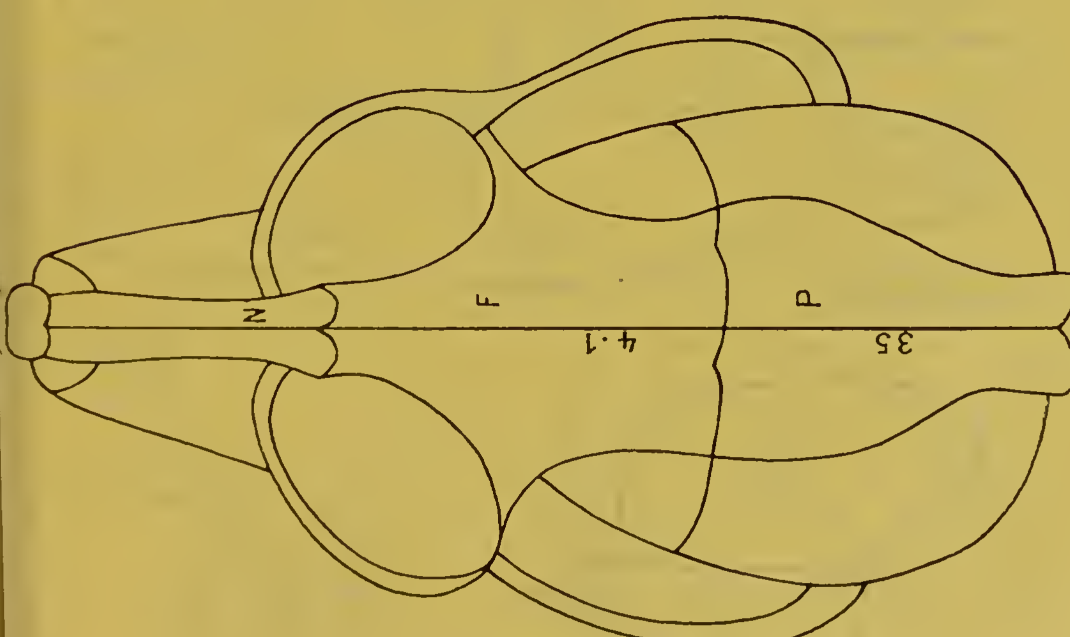

Fig. 45.
Lemur.

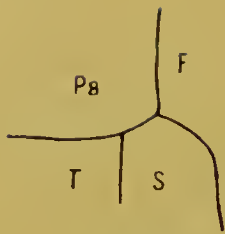

Fig. 47.
Prosimia
Melanocephalus.

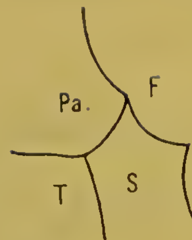

Fig. 48.
Prosimia
nigrifrons.

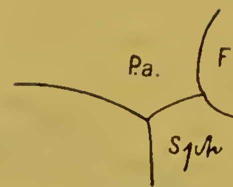

Fig. 49.
Propithecus
Edwardsi.

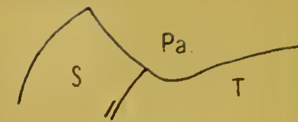

Fig 50.
Nycticebus Edwardsi.

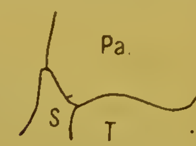

Fig. 51.
Lepidolemur microdon.

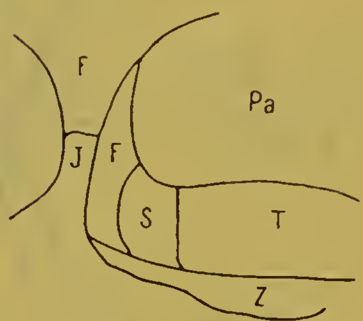

Fig. 52.
Indris brevicaudatus.

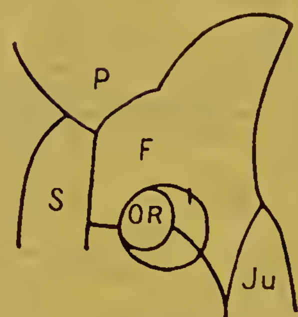

Fig. 53.
Propithecus homomelas.

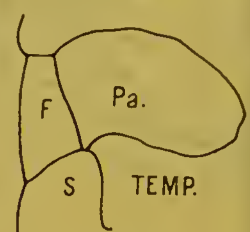

Fig. 54.
Loris gracilis.

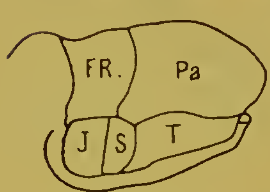

Fig. 55.
Tarsius spectrum.

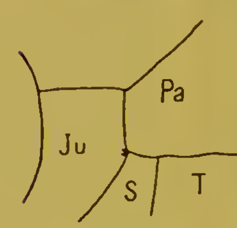

Fig. 56.
Hapale iacchus.

Fig. 57.
Hapale iacchus.

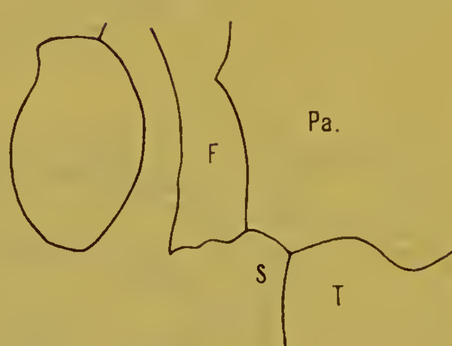

Fig. 58.
· Cheiromys.

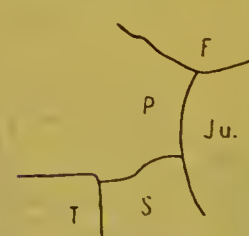

Fig. 59.
Cebus.

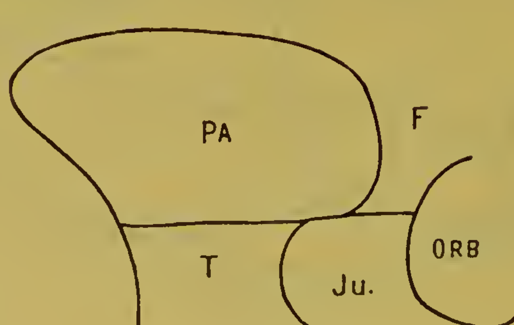

Fig. 60.
Chrysothrix sciurea.

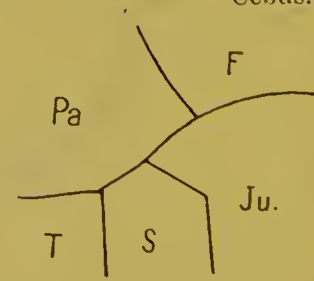

Fig. 61.
Cebus.

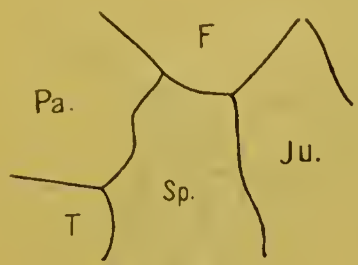

Fig. 62.
Mycetes.

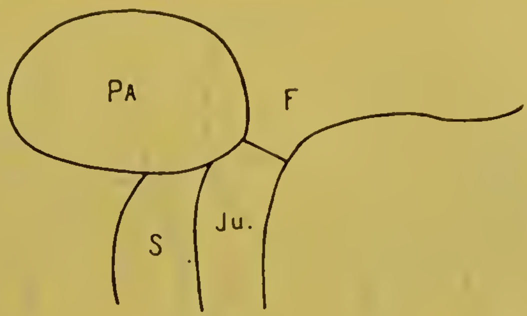

Fig. 63.
Lagothrix Humboldti.

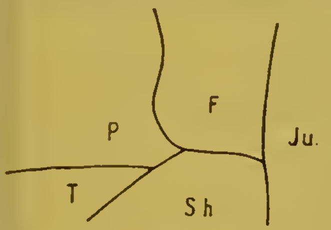

Fig. 64.
Mycetes.

Fig. 65.
Cynocephalus anubis.

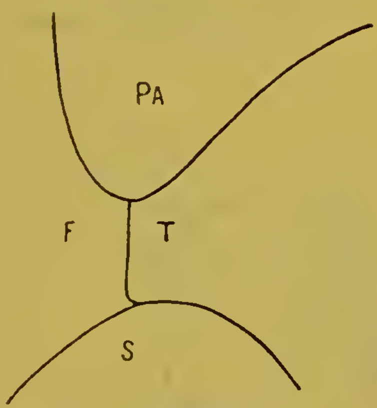

Fig. 66.
Cynocephalus niger.

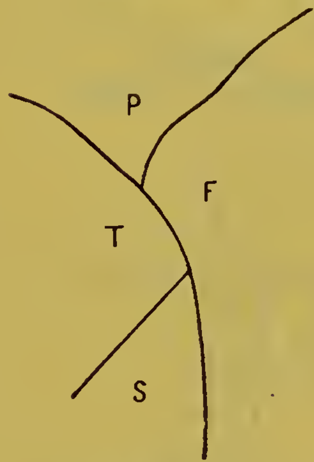

Fig. 67.
Cynocephalus sphinx.

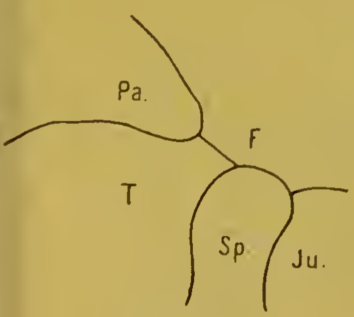

Fig. 68.
Macacus cynomolgus.

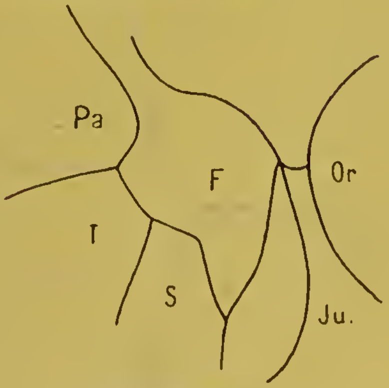

Fig. 69.
Macacus cynomolgus.

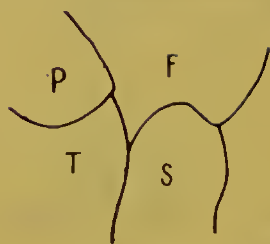

Fig. 70.
Macacus nemestrinus.

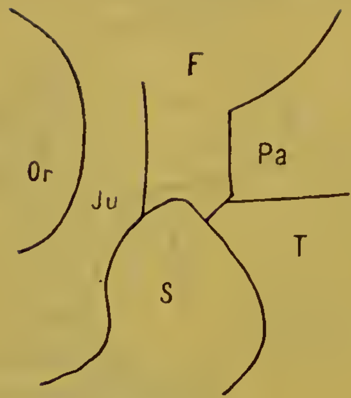

Fig. 71.
Macacus Sp.

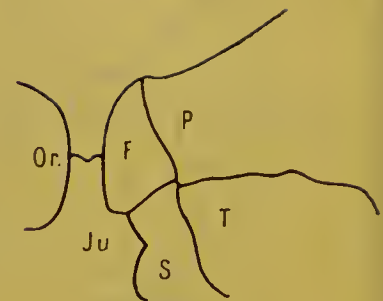

Fig. 72.
Semnopithecus leucoprymnus.

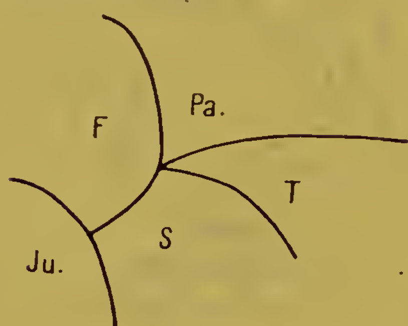

Fig. 73.
Semnopithecus obscurus.

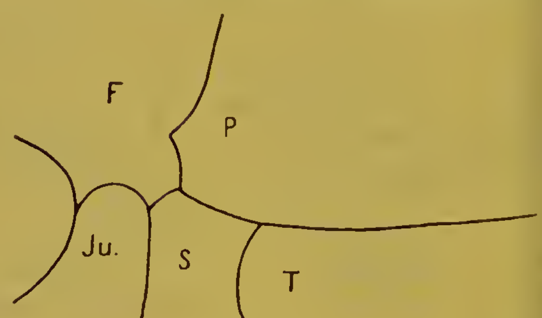

Fig. 74.
Semnopithecus entellus.

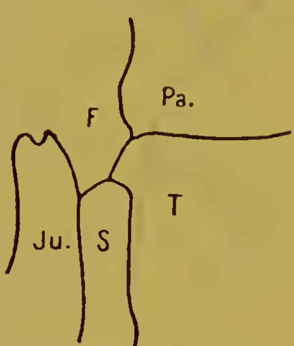

Fig. 75.
Semnopithecus obscurus.

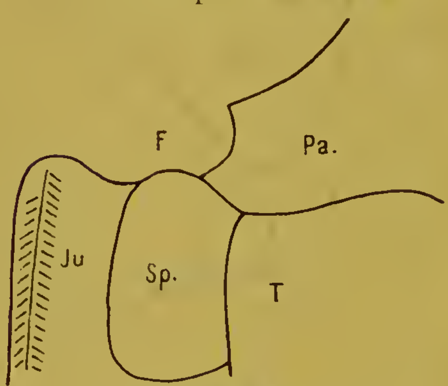

Fig. 76.
Semnopithecus (Sp.).

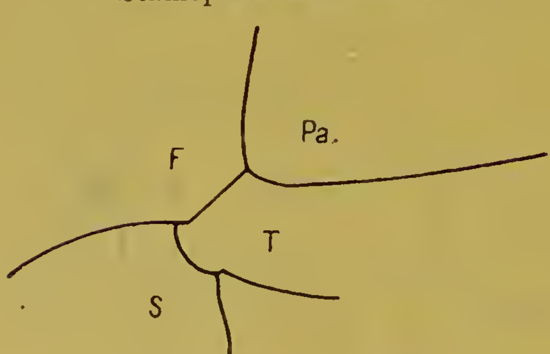

Fig. 77.
Semnopithecus maurus.

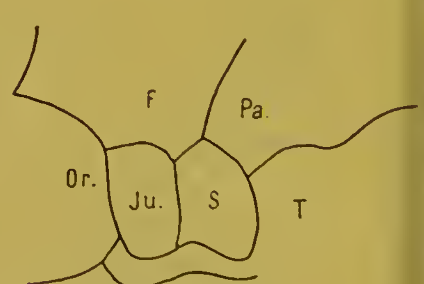

Fig. 78.
Hylobates hainanus.

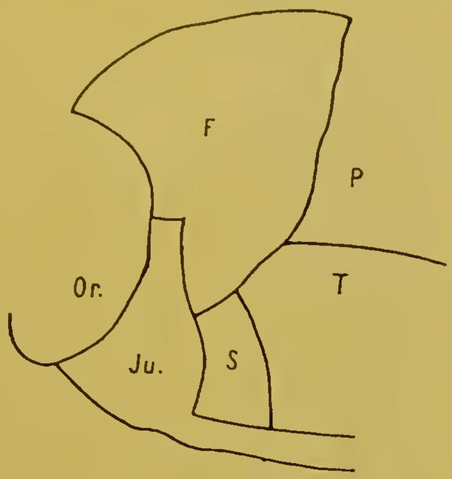

Fig. 79.
Chimpanzee.

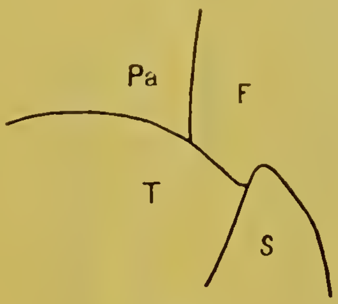

Fig. 80.
Gorilla (Liverpool).

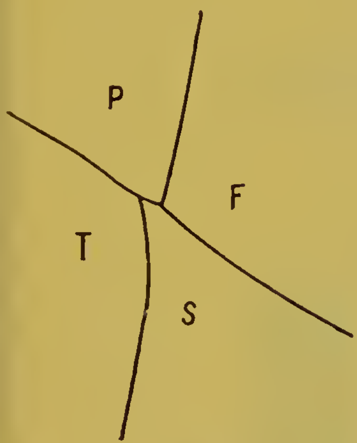

Fig. 81.
Gorilla.

Fig. 82.
Homo (R. C. S. Dublin).

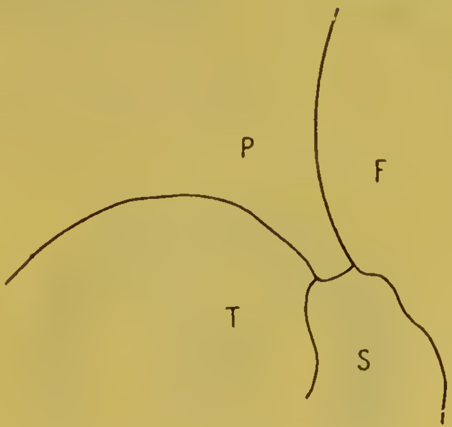

Fig. 83.
Australian (Aborigin).

Buchdruckerei Richard Hahn (H. Otto), Leipzig.